2015 Los Angeles County
Cumulative Antibiogram Data
Gram-Negatives

Methodology Notes for Gram-Negatives:

- At least 25% of laboratories submitting data were using outdated breakpoints (higher than currently recommended) for carbapenems in 2015 when testing the gram-negative bacteria listed here. Consequently, %S data for ertapenem and meropenem may be erroneously high.
- %S for carbapenems varies considerably among facilities
- Meropenem results should not be used to predict imipenem results for any species, nor imipenem used to predict meropenem results.
- Proteus, Providencia, and Morganella are intrinsically less susceptible to imipenem than to meropenem. Imipenem should not be used to classify Proteus, Providencia, or Morganella isolates as CRE.
- For fluoroquinolones, % susceptibility was obtained from both ciprofloxacin and levofloxacin data combined for each facility. The % susceptibility statistic presented is whichever of these two agents revealed the higher value at each facility.

Acinetobacter baumannii clonal complex (n=3,189 from 66 Hospitals)			
	Susceptibility (Range)	Number of Isolates	Number of Hospitals
Ampicillin-Sulbactam	-	-	-
Piperacillin-Tazobactam	33.3% (0-81%)	1,873	41
Ceftriaxone	11.3% (0-61%)	1,475	29
Ceftazidime	30.2% (2-100%)	2,184	42
Cefepime	33.8% (3-82%)	1,864	35
Imipenem	-	-	-
Meropenem	52.9% (15-100%)	1,561	34
Amikacin	43.2% (0-80%)	2,004	36
Gentamicin	40.8% (10-100%)	2,970	62
Tobramycin	46.1% (14-100%)	2,126	46
Ciprofloxacin/Levofloxacin	32.7% (3-100%)	3,024	62
TMP-SMX	48.8% (18-84%)	2,859	59

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:

Insufficient data were available for ampicillin-sulbactam and minocycline which might be useful for some strains of *Acinetobacter baumannii*.

Citrobacter freundii (n=1,975 isolates from 43 Hospitals)			
	Susceptibility (Range)	Number of Isolates	Number of Hospitals
Piperacillin-Tazobactam	87.1% (63-100%)	1,823	44
Ceftriaxone	82.1% (56-100%)	1,869	46
Ceftazidime	83.2% (63-100%)	1,503	37
Cefepime	98.2% (90-100%)	1,713	39
Ertapenem	99.0% (90-100%)	1,156	24
Imipenem	-	-	-
Meropenem	98.5% (75-100%)	1,142	24
Amikacin	99.8% (85-100%)	1,536	38
Gentamicin	92.0% (72-100%)	1,924	48
Tobramycin	92.9% (69-100%)	1,138	33
Ciprofloxacin/Levofloxacin	91.0% (72-100%)	1,975	49
TMP/SMX	80.6% (54%-100%	1,939	48

Citrobacter koseri (n=631 isolates from 23 Hospitals)			
	Susceptibility (Range)	Number of Isolates	Number of Hospitals
Ampicillin-Sulbactam	-	-	-
Piperacillin-Tazobactam	98.7% (89-100%)	631	23
Ceftriaxone	95.7% (21-100%)	631	23
Ceftazidime	96.7% (75-100%)	427	16
Cefepime	100% (100%)	456	18
Ertapenem	100% (100%)	223	9
Imipenem	-	-	-
Meropenem	100% (100%)	184	7
Amikacin	99.0% (89-100%)	389	15
Gentamicin	98.7% (93-100%)	631	23
Tobramycin	99.1% (94-100%)	428	16
Ciprofloxacin/Levofloxacin	98.9% (84-100%)	631	23
TMP/SMX	95.5% (74%-100%	601	22

Enterobacter spp. (n=8,122 from 66 Hospitals)			
	Susceptibility (Range)	Number of Isolates	Number of Hospitals
Piperacillin-Tazobactam	82.3% (47-97%)	7,507	63
Ceftriaxone	80.2% (38-97%)	7,307	57
Ceftazidime	82.0% (38-97%)	6,204	51
Cefepime	95.9% (38-100%)	7,040	51
Piperacillin-Tazobactam	82.3% (47-97%)	7,507	63
Ertapenem	95.8% (54-100%)	4,417	23
Imipenem	-	-	-
Meropenem	98.7% (54-100%)	4,638	33
Amikacin	99.7% (77-100%)	6,235	50
Gentamicin	96.8% (54-100%)	7,972	64
Tobramycin	95.6% (54-100%)	4,630	49
Ciprofloxacin/Levofloxacin	96.1% (46-100%)	8,120	66
TMP-SMX	91.5% (54-100%)	8,018	65

Escherichia coli (n=139,212 isolates from 73 Hospitals)			
	Susceptibility (Range)	Number of Isolates	Number of Hospitals
Ampicillin-Sulbactam	54.6% (35%-68%)	25,534	19
Piperacillin-Tazobactam	93.2% (65-98%)	115,257	54
Ceftriaxone	85.6% (59-93%)	105,020	50
Ceftazidime	86.1% (57-94%)	95,157	45
Cefepime	85.7% (58-95%)	90,175	42
Ertapenem	99.7% (82-100%)	78,427	31
Imipenem	-	-	-
Meropenem	99.9% (99-100%)	84,318	29
Amikacin	98.7% (87-100%)	104,151	51
Gentamicin	85.6% (73-91%)	129,487	65
Tobramycin	81% (63-92%)	67,956	48
Ciprofloxacin/Levofloxacin	70.1% (30-88%)	129,130	65
TMP-SMX	65.6% (45-76%)	123,819	65

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:

Percent susceptible for oral agents for management of urinary tract infection, particularly trimethoprim-sulfamethoxazole and fluoroquinolones, is relatively low. Insufficient data were available for other oral agents which might be considered for urinary tract infections, such as nitrofurantoin, fosfomycin, amoxicillin-clavulanic acid and narrow-spectrum cephalosporins.

Klebsiella spp. (n=30,655 from 72 Hospitals)			
	Susceptibility (Range)	Number of Isolates	Number of Hospitals
Ampicillin-Sulbactam	-	-	-
Piperacillin-Tazobactam	83.9% (25-96%)	25,586	57
Ceftriaxone	85.5% (34-97%)	23,006	52
Ceftazidime	85.8% (34-97%)	19,120	43
Cefepime	84.8% (34-97%)	19,895	43
Ertapenem	97.6% (55-100%)	15,578	29
Imipenem	-	-	-
Meropenem	96.8% (55-100%)	17,025	29
Amikacin	93.7% (33-100%)	22,223	49
Gentamicin	91.1% (57-98%)	27,934	63
Tobramycin	81.5% (26-97%)	16,128	47
Ciprofloxacin/Levofloxacin	86.0% (28-97%)	28,047	64
TMP-SMX	81.8% (37-92%)	26,934	63

Morganella spp. (n=2,235 isolates from 52 Hospitals)			
	Susceptibility (Range)	Number of Isolates	Number of Hospitals
Ampicillin-Sulbactam	-	-	-
Piperacillin-Tazobactam	96.0% (43-100%)	2,233	52
Ceftriaxone	87.5% (63-100%)	2,055	47
Ceftazidime	81.1% (53-100%)	1,811	40
Cefepime	97.6% (81-100%)	1,921	42
Ertapenem	100% (100%)	1,148	24
Imipenem	67.5% (33-100%)	572	16
Meropenem	99.7% (88-100%)	1,127	23
Amikacin	98.5% (75-100%)	1,913	42
Gentamicin	70.7% (33-100%)	2,234	52
Tobramycin	85.7% (74-99%)	1,358	35
Ciprofloxacin/Levofloxacin	59.6% (15-86%)	2,231	52
TMP/SMX	54.5% (24%-80%	2,154	50

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:

Proteus, Providencia, and Morganella are intrinsically less susceptible to imipenem than to meropenem. Imipenem should not be used to classify Proteus / Providencia / Morganella isolates as CRE.

Clinicians should not use results of imipenem testing to infer activity of meropenem for any species.

Proteus spp. (n=16,908 from 68 Hospitals)			
	Susceptibility (Range)	Number of Isolates	Number of Hospitals
Ampicillin-Sulbactam	-	-	-
Piperacillin-Tazobactam	97.5% (31-100%)	15,836	63
Ceftriaxone	90.4% (67-99%)	15,682	61
Ceftazidime	91.6% (63-100%)	13,067	49
Cefepime	91.7% (61-100%)	13,832	52
Ertapenem	98.9% (88-100%)	9,018	32
Imipenem	70.8% (11%-100%)	3,561	16
Meropenem	98.5% (63-100%)	9,903	32
Amikacin	98.7% (87-100%)	13,470	53
Gentamicin	82.9% (61-93%)	16,554	66
Tobramycin	84.1% (67-100%)	10,176	49
Ciprofloxacin/Levofloxacin	67.8% (27-97%)	16,738	67
TMP-SMX	67.6% (35-100%)	16,491	66

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:

Proteus, Providencia, and Morganella are intrinsically less susceptible to imipenem than to meropenem. Imipenem should not be used to classify Proteus / Providencia / Morganella isolates as CRE.

Clinicians should not use results of imipenem testing to infer activity of meropenem for any species.

Providencia spp. (n=1,618 isolates from 36 Hospitals)			
	Susceptibility (Range)	Number of Isolates	Number of Hospitals
Ampicillin-Sulbactam	-	-	-
Piperacillin-Tazobactam	72.5% (45-97%)	1,542	35
Ceftriaxone	66.2% (30-100%)	1,404	32
Ceftazidime	55.2% (33-82%)	1,315	29
Cefepime	76.9% (58-97%)	1,285	28
Ertapenem	88.2% (68-100%)	228	8
Imipenem	73.5% (26-100%)	619	15
Meropenem	90.1% (55-100%)	553	14
Amikacin	91.3% (65-100%)	1,442	32
Gentamicin	11.7% (0-73%)	1,259	29
Tobramycin	14.4% (0-73%)	960	23
Ciprofloxacin/Levofloxacin	11.2% (0-40%)	1,512	34
TMP/SMX	46.0% (23-85%)	1,513	34

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:

Proteus, Providencia, and Morganella are intrinsically less susceptible to imipenem than to meropenem. Imipenem should not be used to classify Proteus / Providencia / Morganella isolates as CRE.

Clinicians should not use results of imipenem testing to infer activity of meropenem for any species.

Some *Providencia* spp. are known to have intrinsic resistance to gentamicin and tobramycin, but not amikacin. These data support this previously observed pattern.

Pseudomonas aeruginosa (n=22,804 from 73 Hospitals)			
	Susceptibility (Range)	Number of Isolates	Number of Hospitals
Piperacillin-Tazobactam	82.8% (62-100%)	20,040	66
Ceftazidime	81.7% (6-94%)	18,315	59
Cefepime	83.6% (65-98%)	19,015	59
Meropenem	81.7% (54-97%)	14,261	39
Imipenem	-	-	-
Amikacin	95.1% (74-100%)	19,491	62
Gentamicin	83.2% (48-95%)	22,271	70
Tobramycin	91.0% (77-97%)	19,850	61
Ciprofloxacin/Levofloxacin	68.7% (45-90%)	22,132	71

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:

Carbapenem resistance among *Pseudomonas* spp. is relatively common in Los Angeles County. These data are particularly relevant to the empiric management of sepsis, where microbiologically active therapy is crucial (Kolleff et al. *Chest*. 1999; Kumar et al. *Critical care Medicine*. 2006).

One potential approach to improve the probability of microbiologically active therapy is the inclusion of adjunctive therapy with a non-beta-lactam antibiotic. (IDSA HAP/VAP guidelines – Kalil et al. *Clinical Infectious Disease*, 2016; Gutierrez-Gutierrez et al. *Lancet Infectious Disease*. 2017) Fluoroquinolone susceptibility is relatively low, compared to aminoglycosides. This may be relevant to management of pneumonia and other hospital-acquired infections where *Pseudomonas* spp. infection is likely.

Serratia spp. (n=2,676 isolates from 58 Hospitals)			
	Susceptibility (Range)	Number of Isolates	Number of Hospitals
Piperacillin-Tazobactam	90.9% (55-100%)	2,098	42
Ceftriaxone	89.5% (55-100%)	2,403	51
Ceftazidime	91.2% (36-100%)	2,188	47
Cefepime	96.6% (67-100%)	2,203	45
Ertapenem	97.1% (63-100%)	1,414	29
Imipenem	-	-	-
Meropenem	98.3% (92-100%)	1,579	30
Amikacin	96.6% (29-100%)	2,188	47
Gentamicin	97.1% (73-100%)	2,757	57
Tobramycin	85.4% (29-100%)	1,677	39
Ciprofloxacin/Levofloxacin	88.1% (33-100%)	2,646	57
TMP/SMX	96.8% (33%-100%	2,544	56

Stenotrophomonas maltophilia (n=1719 isolates from 50 Hospitals)			
	Susceptibility (Range)	Number of Isolates	Number of Hospitals
Ceftazidime	37.4% (0-60%)	848	18
Ciprofloxacin/Levofloxacin	78.8% (33-100%)	1,052	29
TMP/SMX	90.4% (0%-100%	1,548	43

Comments from LA County Healthcare-Associated Infection and Antibiotic Resistance Committee:

Clinicians should be aware that local laboratories reported susceptibility results for beta-lactam antibiotics to which *Stenotrophomonas maltophilia* are intrinsically resistant; Piperacillin-Tazobactam (n=3 hospitals), Ceftriaxone (n=4 hospitals), Cefepime (n=2 hospitals), Ertapenem (n=2 hospitals), and Meropenem (n=4 hospitals). (Sanchez et al, *Stenotrophomonas maltophilia drug resistance*, Future Microbiology, Vol 4, No 6, 2009; Sanford Guide Antimicrobial Therapy 2017; Brooke, JS. *Stenotrophomonas maltophilia: An Emerging Global Opportunistic Pathogen*, Clinical Microbiology Reviews, Vol 25, No 1, p.2-41, 2012).

We also note that the local antibiogram reports for Stenotrophomonas maltophilia include aminoglycoside antibiotics; Amikacin (n=3 hospitals), Gentamicin (n=3 hospitals), and Tobramycin (n=3 hospitals). Resistance testing to aminoglycosides can be complicated by multiple factors, including temperature at which the isolate is tested. (Brooke, JS. *Stenotrophomonas maltophilia: An Emerging Global Opportunistic Pathogen*, Clinical Microbiology Reviews, Vol 25, No 1, p.2-41, 2012) Clinicians should be aware that local testing may not be reliable and that aminoglycosides show poor activity against *Stenotrophomonas maltophilia.*